

# **EXPLORE SCIENCE**



### MSR Recent Accomplishments

- The MOU establishing the ESA/NASA MSR program partnership was signed by the NASA Administrator and the ESA Director General on October 5<sup>th</sup>
- IRB Final Report Released 11/10/20
- MCR completed 10/19/20
- SMD DPMC conducted 11/23
- APMC scheduled for 12/16/20
- IRB and SRB both endorsed proceeding into Phase A

#### MSR Architectural Overview

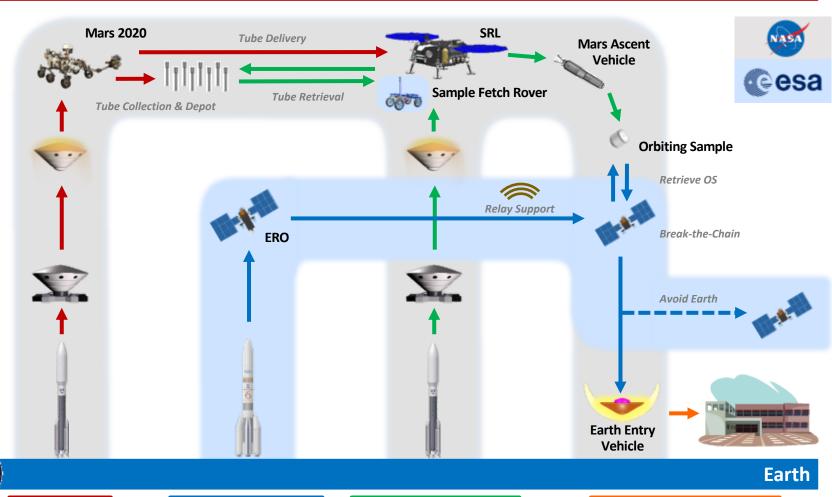




Mars2020

**Earth Return Orbiter** 

Mars



Sample Retrieval Lander

3

**Sample Return and Science** 

## MSR Program Elements

Sample Retrieval Lander (SRL) Touchdown

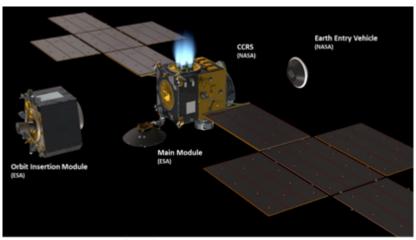




Mars Ascent Vehicle (MAV) Launch

#### Sample Transfer



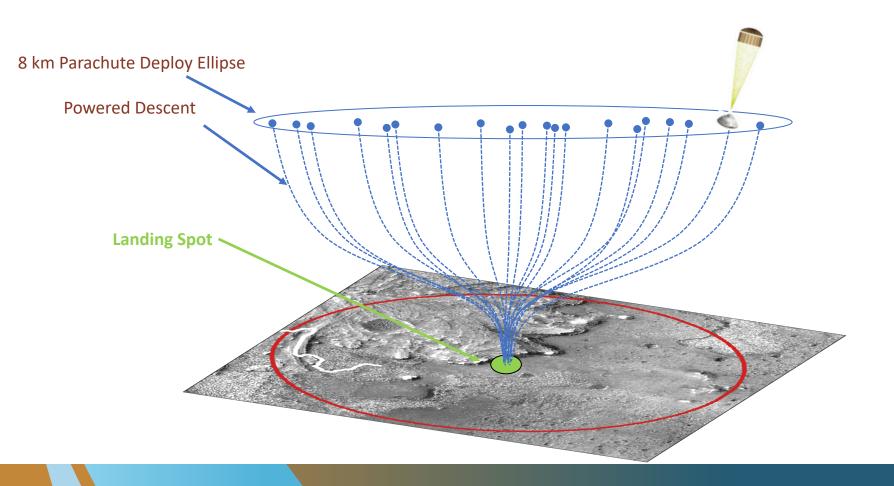


Earth Return Orbiter (ERO)

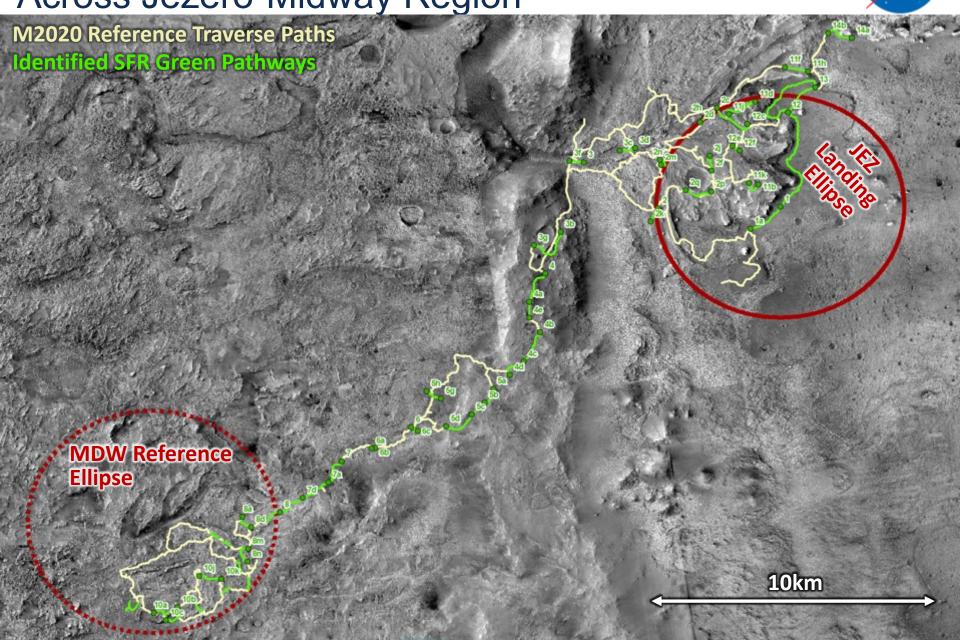
#### SRL EDL - Extended Divert



- SRL will carry enough propellant to fly out the backshell separation ellipse (8 x 8 km) and land at a specific spot (~±20m accuracy)
- Enables new capability of landing at a specific site scouted by Mars 2020



Overview of Green Pathways Across Jezero-Midway Region



#### Rover Size Comparison



MER

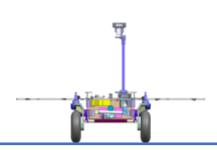


ExoMars



M2020

**SFR** 

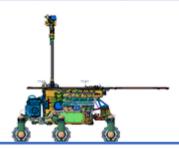


Mass = 173 kg

Number of wheels = 6 Wheel Diameter = 230 mm Wheel Type = Rigid

**Susp Type** = Rocker-Bogie w/ internal diff

**Ground Clearance** = 300 mm



**Mass** = 310 kg

Number of wheels = 6 Wheel Diameter = 285 mm Wheel Type = Compliant

Wheelbase = 1260 mm

Susp Type = 3x Bogie

**Ground Clearance** = est 250 mm



**Mass** = 1030 kg

Number of wheels = 6 Wheel Diameter = 526 mm Wheel Type = Rigid

Wheelbase = 2260 mm

**Susp Type** = Rocker-Bogie w/ external diff

**Ground Clearance** = 584 mm



Mass = < 230 kg

Number of wheels = 4 Wheel Diameter = 550 mm Wheel Type = Compliant, Mesh

Wheelbase = 1550 mm

**Susp Type** = 4 wheel w/ external diff

Ground Clearance = 350 mm

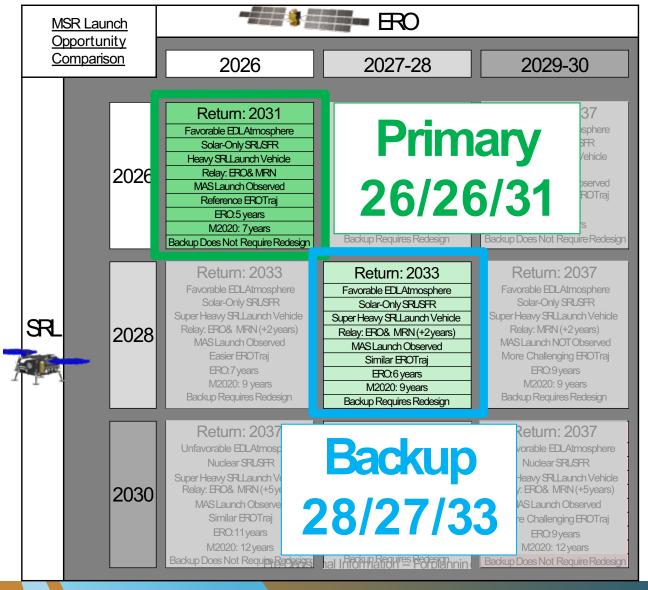


### Resiliency Decisions and Sample Safe States

- Through architecture design, created numerous sample-safe states and decision events
  - Sample(s) are designed to survive on the Mars surface for a minimum of 10 years
  - Functionally redundant paths for delivering samples to SRL (M2020 and SFR)
  - OS orbit is designed to be stable for a minimum of 10 years
  - OS designed to be capable of returning as many as 30 samples
- In Phase A, team will look carefully at each Phase for additional resiliency
- MSR is using resiliency to guide decision making
  - Testing and V&V programs will be detailed with focus on high risk areas
  - Probabilistic risk assessment will be used as part of the SE&I function to quantify risk as part of the Program decision-making process

### **MSR Launch Opportunities**





26/26/31 Reference Design Slightly Worse than 26/26/31 Worse than 26/26/31 Much Worse than 26/26/31

- Each opportunity is evaluated based upon SRL and ERO designed specifically for that opportunity
- MRN = Mars Relay NetworkMRO, MAVEN, TGO
- Nomenclature: "28/27/33"
  - SRL Launches in 2028
  - ERO Launches in 2027
  - ERO Returns in 2033
- "2027-28" covers the potential for ERO to launch one year earlier and use an Earth flyby prior to utilizing a 2028 Earth - Mars transfer. These options are architecturally similar.

### Science Integration Across Programs

- Science is working closely with system engineers on requirements and essential trade-offs.
- NASA/ESA Mars Sample Return Sample Planning Group Phase 2 (MSPG2) is addressing science and curation planning questions for analyzing returned samples, developing draft requirements for the Sample Receiving Facility.
  - Terms of Reference signed in April 2020, reports expected in Spring 2021
- COSPAR Sample Safety Assessment Protocol Working Group (SSAP) is developing a recommendation for determining when extraterrestrial samples are safe for distribution outside of containment.
  - Report out in Jan/Feb 2021 at COSPAR Assembly
  - NASA interests are represented through Planetary Protection, Mars Science, and US scientists
- An open community workshop for a Perseverance/MSR Sample Caching Strategy Workshop planned Jan. 2021, informing the draft operations M2020/MSR MOU



#### Going Forward- Phase A

- Complete Architectural Trade Studies recommended by IRB
- Continue Technology and Engineering Development plans
- Continue to work Planetary Protection requirements
- Proceed with NEPA process
- Work to ensure MSR coordination with M2020 Phase E sampling operations
- Work to maintain 2026 schedule through PDR, per IRB and SRB recommendations

